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DIRECT SEEDING OF SOUTHERN PINES — A REGENERATION ALTERNATIVE

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This area was aerially seeded to longleaf pine. This species is considered difficult to plant, but provided a good stand in this area.

Direct seeding can be an effective tool for regenerating the southern pines. On many sites it is more economical than planting nursery-grown seedlings or waiting for natural reproduction. It is applicable on some sites where access, terrain, or drainage conditions make planting difficult. Discovery of effective bird, rodent, and insect repellents has made direct seeding possible and practical. It is, however, an operation requiring a high degree of technical skill and knowledge. The key to its successful application lies in obtaining the advice and assistance of an experienced direct-seeder.

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Both methods of artificially regenerating southern pines — planting and direct seeding — have a place in southern forestry. Each method has its advantages and disadvantages. Landowners should select that method that best fits their situations.

Advantages and Disadvantages

The choice of a method of regeneration is dependent on the landowners' goals, economic situation, and the capability and condition of the site. What are the reasons for choosing or not choosing direct seeding? The advantages include:

Lower initial costs

May require less site preparation

Aerial seeding of a prepared site. On large tracts, seeding by air is fast and comparable in cost to most ground methods.

Less labor and heavy equipment needed than for planting

Natural root system — no L or J roots

Easier to apply on remote or inaccessible areas

Flexibility — may be able to regenerate quicker following fire or other disasters.

Easier to regenerate large areas quickly

Easier to regenerate some difficult-to-plant species.

Disadvantages include:

Less control over spacing and stocking

Longer rotations needed

Lower yields as a rule

Wasteful of genetically improved seed

Loss of a year's growth

May need precommercial thinning

Irregular stands not well suited for mechanical harvesting

More difficult access for fire equipment

Seed washing on steep slopes results in loss of seed or uneven distribution.

When to Use Direct Seeding

Increasing planting costs, a growing shortage of labor, the need for prompt restocking of forestland, and the sheer magnitude of the regeneration job facing the South make direct seeding worthy of consideration. It can be used to regenerate open lands and, with effective site preparation, those partially or wholly occupied by brush or low-value hardwoods.

Generally speaking, any area that can be planted can be direct seeded. Specific exceptions include localized tracts of deep upland sands whose surface dries so rapidly that moisture is inadequate to sustain germination of broadcast-sown seed. On such sites seed should be covered with soil so as to insure consistent success. Optimum depth of soil covering for most species is ½ inch. There are also general areas where recurrent droughts or soils with poor moisture-holding capacity make pine regeneration difficult to achieve by any means. In such places, notably Oklahoma and Texas, planting is more reliable than seeding. Sowing should not be attempted on slopes if soil or cover conditions allow excessive washings of the seed in heavy rains. Sowing should not be tried on poorly drained sites where the seed or seedlings will be under water for more than one or two weeks unless timed to avoid this condition. Finally, areas subjected to heavy grazing should be avoided.

The two main reasons for direct seeding are lower initial costs (1/3 to 1/2 the cost of planting) and a growing shortage of hand labor. Major objections to broadcast seeding, the least costly method, are that it gives less control of stocking than does planting and that trees are not established in rows. Some forest managers believe that regulation of the number of trees per acre justifies the higher costs of planting, since stocking influences tree size and time of first thinning. Moreover, well-defined rows are desirable for mechanical harvesting systems which are increasingly employed in the South and also make access for fire suppression much easier.

SPECIES SELECTION

The landowner should choose the species that will meet his objectives: probably one superior in growth and yield. In general, *loblolly* should be sown in the Piedmont and upper Coastal Plain where the terrain is rough and hardwood competition severe; *slash* in the southern Coastal Plain flatwoods; *longleaf* on areas where it formerly grew; *shortleaf* and/or *Virginia pine* in the northern reaches of the South too cold for loblolly; and *sand pine* on the deep sands of Florida and south Georgia.

SITE PREPARATION

Thorough site preparation is essential to expose the mineral soil that pine seeds need for germination, and to control competing vegetation that will interfere

Row seeders help control density, resulting in more regular stands for easier access for fire protection and future harvesting.

with the survival and early growth of the new stand. Fire is the simplest and least expensive method of site preparation and, on sites without a heavy hardwood component, is often enough. In most situations, burns should be made at least four to six months preceding sowing. On areas with hardwood trees, brush burning should be combined with mechanical treatments like disking, chopping, shearing, or deadening with injectors. On sheared areas it is not necessary to windrow as for planting unless row seeders are to be used.

Disking is a more intensive treatment that has been widely used on open, grassy sites and has proved useful in some hardwood stands. While disking often improves survival (particularly in dry years) and early growth, the initial seedling catch may be somewhat less than on comparable undisked, burned seedbeds where some seeds can be silted over too deeply by loose soil. Such losses can be minimized by disking in late summer or early fall and letting the loose soil settle before sowing.

Heavy equipment operations such as bulldozing, rootraking, chaining, shearing, or chopping create an excellent mineral seedbed but are generally too costly for the small landowner. On many small holdings, a hot burn followed by tree injection is sufficient.

SEED HANDLING AND TREATMENT

Only good seed should be used. Experience has shown that in procuring seed, 85 percent viability is an ideal minimum. Commercially purchased seed should have less than 2 percent impurities by weight, a minimum of 95 percent sound seed, and a moisture content of 10 percent or less. In general, seed from the local geographic area should be used, making sure that it was collected from the best stands possible. However, there are areas where other than local seed is recommended for its superior growth and disease resistance.

Seed should be refrigerated immediately after receipt; 34 degrees to 36 degrees F. is safe for short periods of time. Before use, the seed lots should be carefully tested to determine if:

1) Viability meets minimum standards.
2) Sowing rates need to be adjusted.
3) Stratification is needed for spring sowing.

It is advisable to have the seed tested by the Forest Service's Eastern Tree Seed Laboratory, Box 819, Macon, Georgia, 31202, or by the State Seed Laboratory if that service is available for tree seed.

Cold stratification improves the speed and completeness of germination if the seed is dormant. Rapid germination is essential in spring sowing because it reduces the time seed is exposed to predators, assures maximum germination while weather conditions are optimum, and gives seedlings time to develop before the onset of hot, dry weather. If tests to determine stratification needs are impractical, stratify loblolly, shortleaf, and slash pine seed for 30 days. Longleaf seed does not need stratification. The main requirements in stratification are to keep the seed moist and at a temperature between 36° and 40° F.

All seed should be treated by trained personnel with a repellent containing thiram (arasan) and endrin which will give a high degree of protection against seed-eating birds, small mammals, and troublesome insects common to most southern pine sites. It is impractical for small landowners to treat seed. Commercial seed companies sell stratified, repellent-treated seed at a fair price dictated by the law of supply and demand. At the moment, loblolly seed is selling for $12.00 per pound with additional charges of 10 cents for stratifying and 50 cents for applying repellent coating. Endrin is highly toxic and treated seeds should be handled cautiously.

SOWING METHODS AND TECHNIQUES

Longleaf should be sown in the fall after natural seedfall and after soil moisture has been recharged by 2 to 4 inches of rain (but before mid-December), or in the early spring. Loblolly, shortleaf, and slash pine seed should be sown in the spring about the time the first blooms appear on redbud and red maple. Normally, prolonged periods of freezing weather are past, soil moisture is adequate, and daily temperatures are reaching levels needed for germination. Stratified seeds sown in mid-February usually complete germination by mid-April, though prolonged cool weather or drought can extend germination into May.

Sowing rates are influenced by the quality of seed, method of sowing, seedbed condition, and stocking desired. Recommendations for broadcast sowing on average sites under normal working conditions are 2.5 pounds dry, uncoated seed per acre for longleaf, 0.5 pound for loblolly, 0.6 pound for slash, and 0.2 pound for shortleaf. Coating adds about 10 percent to the weight, stratification 25 percent. These rates provide between 9,000 and 10,000 viable seeds per acre. For sowing strips, rows, or spots the rate is much less. Where seedbed conditions are poor the rates cited above can be increased by a third or more. One company has had good results using 0.36 pound per acre of loblolly seed; another company seeding dry sands uses 1.33 pound of loblolly seed. A third company sows 6,000 viable seed per acre.

Hand sowing is the oldest form of direct seeding. For broadcasting on areas up to several hundred acres in size, hand-cranked seeders, equipped with a metering device, are efficient. Where movement and swatch control are easy, a daily production of 15 acres per man is common. Spot seeding on raked spots, two feet in diameter, spaced 8 x 8 feet, has been employed on areas with a ground cover of hardwood litter, but care must be taken to scatter the cleared-off debris to prevent blowback from smothering the seedlings. Burning before spot seeding makes the job easier and eliminates blowback. These two methods are ideal for small landowners.

Considerable seeding from the ground, however, has been done with rowseeding machines. Most row seeders plow a furrow or pulverize a narrow strip with disk blades and then meter out seeds and press them into the mineral soil with packing wheels.

About 75 percent of the total acreage seeded has been sown from the air, either with small fixed wing craft or helicopters. On operations exceeding 500 acres, aerial seeding is comparable in cost to most ground methods of broadcasting seed. It is also fast, permitting completion of work while conditions are suitable for germination. Frequently, it is the only practical means of sowing inaccessible terrain or debris-covered areas. Properly calibrated and controlled, aerial seeding is the most accurate broadcasting method, giving complete coverage regardless of terrain, brush, or debris. A number of small landowners in the same general area can band together to employ a helicopter or fixed-wing aircraft for direct seeding.

EVALUATION AND FOLLOW-UP

Despite all precautions, birds, small and large wild animals, livestock, insects, disease, and weather will take their toll on the seed and seedlings in varying degrees. An evaluation of the situation on the seeding area prior to sowing and systematic observations made periodically after sowing indicate the precautions needed to eliminate needless losses of seed and seedlings.

We recommend that two seedling inventories be taken — one at the beginning of the summer when most of the germination is completed (needed for approval for FIP cost-sharing); the other at the end of the first growing season when danger of heavy mortality is past. The difference between the two inventories reflects the first summer mortality and will be useful information for seeding similar areas. To sample broadcast areas for a probable accuracy of ± 20 percent, stake out a grid of 25 mil-acre plots (radius 3 feet, 8.7 inches). Count the number of seedlings on each plot and multiply the average by 1,000 to get

Hand sowing is the oldest method of direct seeding. This stand of low value hardwoods was injected prior to seeding.

seedlings per acre. Stocking is the percent of mil-acres with at least one seedling present. When numbers per acre are between 1,500 and 3,500, the usual range of stocking is between 60 and 80 percent. A commonly accepted minimum criterion for success is 55 percent. Should the stocking be less than 55 percent, wait another year and take another inventory before regenerating by reseeding or planting. Some areas have been seeded twice, unnecessarily. Eight out of ten seedings are successful.

Areas with 2,000 or more seedlings per acre at the end of the first growing season should be re-inventoried at age three. If there are then 1,500 or more seedlings per acre living, the area should be given a precommercial thinning promptly in order for its yields to approach yields from plantations. Some seeded areas may need release from hardwood sprouts by chemical sprayings.

Direct seeding is not a job for the neophyte. Always obtain the advice and assistance of a forester experienced in this regeneration technique.

Check List for Direct Seeders

Site — A good planting chance? Bird or rodent population? Mineral soil exposed? Excessive slope?

Site preparation — Burn? Disk? Bulldoze? Chop?

Soil moisture — Adequate? Favorable rainfall patterns? Drought history? Fast-drying, upland sand?

Availability of seed — Local? Seed well adapted to site? Repellent treated? Stratified? Viability tested?

Seeding rate — Species? Poor, average, or excellent seedbed conditions? Viability?

Method — Broadcast by hand? Spot? Row seeding? Aerial?

Seedling inventory — Plot layout? June? October? End of third year?

Post seeding treatment — Release from hardwood sprouts? Precommercial thinning?

The use of endrin for coating seed is under review by EPA at the time this publication went to press. If registration of endrin is withdrawn, the use of direct seeding will need to be evaluated with local seed predator problems in mind.

Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

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